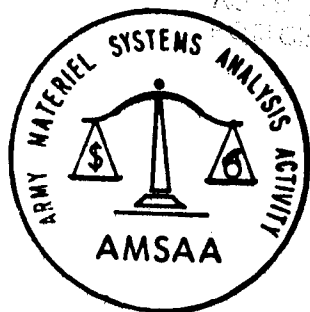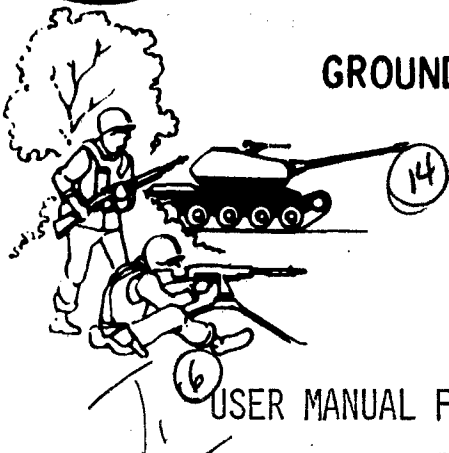N-20238.10

AMSAA

GROUND WARFARE DIVISION

INTERIM NOTE
NO. G-62-B

USER MANUAL FOR THE AMSAA WAR GAME (AMSWAG)
DATA PREPROCESSORS

Robert D. Orlov
Frederick M. Campbell
Ronald A. Marking
Richard J. Mezan

MAY 1979

Best Available Copy

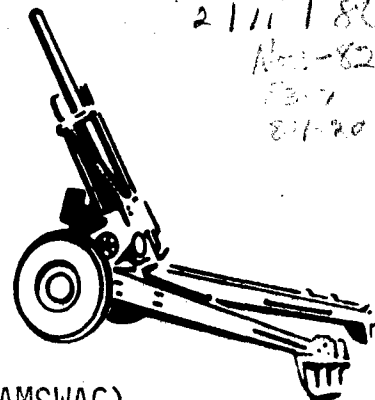## U. S. ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY
ABERDEEN PROVING GROUND, MARYLAND

Ground Warfare Division

Interim Note No. G-62-B

User Manual for the AMSAA War Game (AMSWAG)

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Approved for public release; distribution unlimited

U.S. Army Materiel Systems Analysis Activity
Aberdeen Proving Ground, Maryland 21005

Ground Warfare Division

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May 1979

UNCLASSIFIED   ABSTRACT

A user manual for the data (constant data, vulnerability, and expected time to kill) preprocessor programs to the AMSAA War Game (AMSWAG) computer combat main model is provided. The order, content, and format of the input cards to each of the data programs are described. Also, the content and format of the primary output of each of the data programs are described.

ACKNOWLEDGEMENT

Table of Contents

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User Manual for the AMSAA War Game (AMSWAG)
Data Preprocessors

1. INTRODUCTION

The purpose of this report is to provide a user manual of the data (constant data, vulnerability, and expected time to kill) preprocessor programs to the AMSAA War Game (AMSWAG) computer combat main model. The main model, supported by all of the necessary preprocessor programs to the model, is a time-sequenced, deterministic, battalion level, force-on-force computer model that simulates a typical attack/defense.

This report is specifically intended to provide a user with the necessary information to correctly prepare the input cards to the data preprocessor programs and to understand the content and format of the primary output from each program.

The report is divided into four sections: a flow diagram of the AMSWAG main model and its preprocessor programs, and then a discussion of the constant data, vulnerability, and expected time to kill preprocessor programs respectively. Each input card to the programs is described on two consecutive pages as follows. The first page discusses the content of the card and the second page the format of the card.

It is important to realize that this user manual is only for the data preprocessor programs.

2. GENERAL FLOW

A general flow diagram of the main blocks of the overall AMSWAG process is presented in Figure 2.1. A more detailed diagram of the individual programs in the overall process is presented in Figure 2.2.

3. CONSTANT DATA PROGRAM

3.1 General Description

The AMSWAG combat simulation requires estimates of round and weapon characteristics. These estimates are referred to as the AMSWAG constant data. The estimates are processed and stored for subsequent use by the AMSWAG main model, thus eliminating the derivation of these estimates for each game. The purpose of the constant data program is to create the AMSWAG constant data base.

7

```
            ┌──────────────┐                    ┌──────────────┐
            │   TACTICAL   │                    │     DATA     │
            │ PREPROCESSORS│                    │ PREPROCESSORS│
            └──────────────┘                    └──────────────┘
                      \                          /
                       \                        /
                        \                      /
                         ↘                    ↙
                         ┌──────────────────┐
                         │     AMSWAG       │
                         │     MODEL        │
                         └──────────────────┘
                                  │
                                  │
                                  ↓
                         ┌──────────────────┐
                         │    ANALYSIS      │
                         │      AND         │
                         │ POSTPROCESSING   │
                         └──────────────────┘
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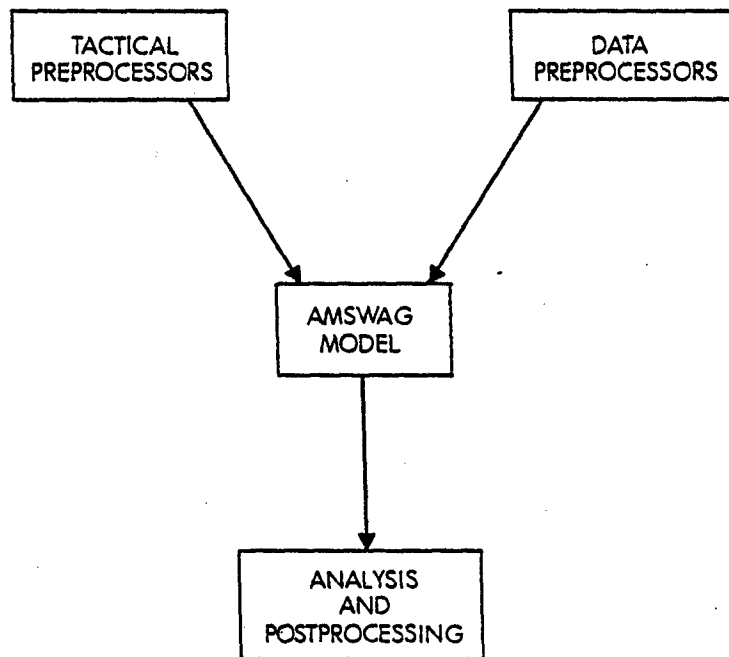
FIGURE 2.1   The AMSWAG Process (General)

8

TACTICAL
PREPROCESSING
STREAM

```
┌──────────────┐
│   TERRAIN    │
│ PREPARATION  │
│  PROGRAMS    │
└──────────────┘
       │
       ▼
┌──────────────┐
│    TRACE     │
│  DEFINITION  │
│   PROGRAM    │
└──────────────┘
       │
       ▼
┌──────────────┐
│   MOBILITY   │
│   PROGRAM    │
└──────────────┘
       │
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┌──────────────┐
│  TIME AND    │
│  LOCATION    │
│   PROGRAM    │
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│    SIGHT     │
│   PROGRAM    │
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│   QUANTIFIED     │
│ UNIT INFORMATION │
│    PROGRAM       │
└──────────────────┘
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DATA
PRE-PROCESSING
STREAM

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┌──────────────┐
│ VULNERABILITY│
│    DATA      │
│   PROGRAM    │
└──────────────┘

┌──────────────┐
│  EXPECTED-   │
│  TIME-TO-    │
│    KILL      │
│    (ETK)     │
│ DATA PROGRAM │
└──────────────┘

┌──────────────┐
│   CONSTANT   │
│    DATA      │
│   PROGRAM    │
└──────────────┘
```

MINEFIELDS USED IN SCENARIO ? — NO

YES

```
┌──────────────┐          ┌──────────────┐
│  MINEFIELD   │───────▶  │     THE      │
│   PROGRAM    │          │   AMSWAG     │
└──────────────┘          │    MODEL     │
                          └──────────────┘
                                 │
                                 ▼
                          ┌──────────────┐
                          │   ANALYSIS   │
                          │     AND      │
                          │POST PROCESSING│
                          └──────────────┘
```
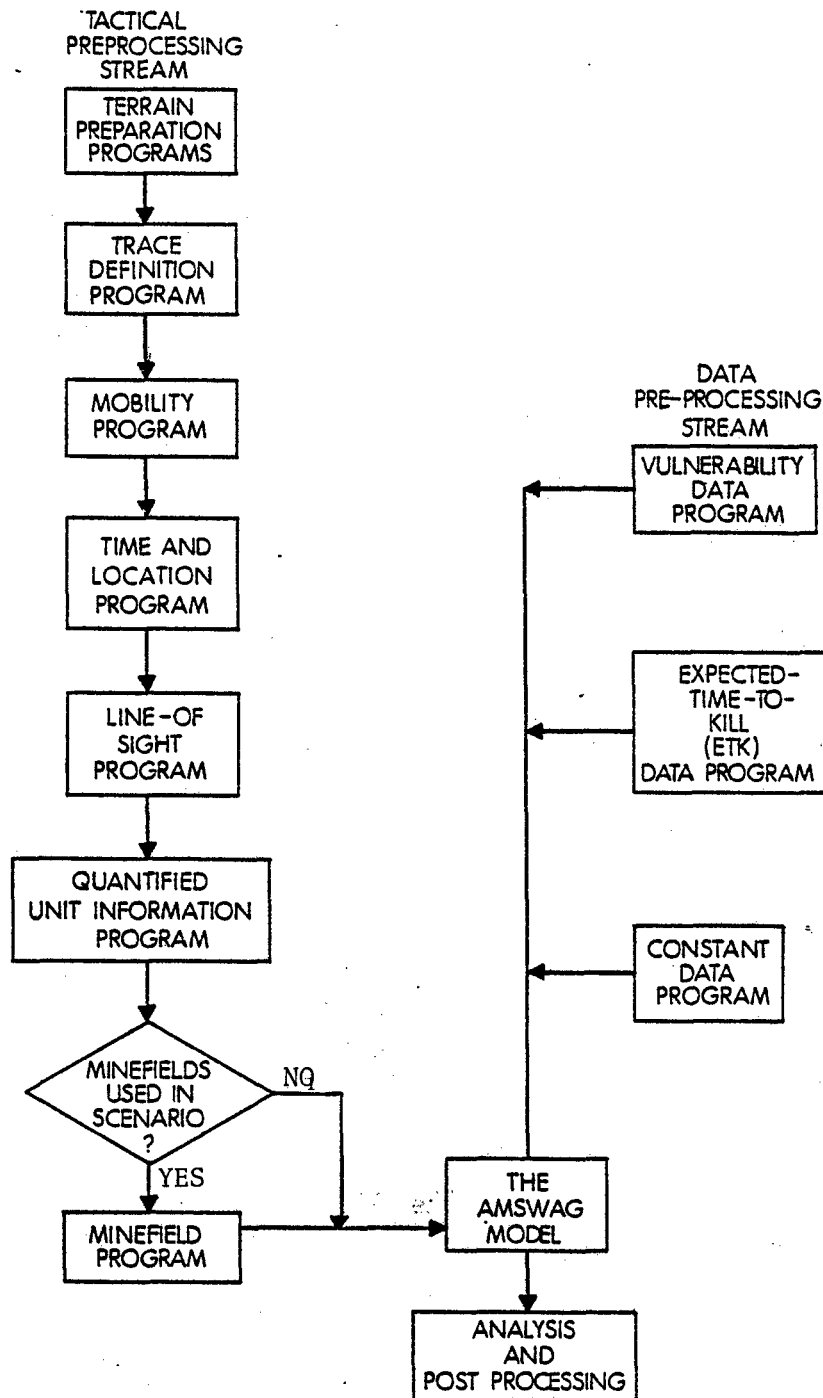
FIGURE 2.2   The AMSWAG   Process   (Detailed).

3.2 Input

Occasionally, one or more input cards possess, except for the titles, identical formats. In these cases, the descriptions of the cards are aggregated into one content and one format page. The individual titles and any specific differences in content of each input card all appear on the one content page.

As a guide, an overview of program input cards is presented in Table 3.1.

The input cards are subdivided into three subsections:

1 - program control cards which initiate execution of the constant data program.

2 - weapon data cards which create a weapon system data record, and

3 - round data cards which create a round data record.

Each subsection is prefaced by a table which lists and describes the cards within that subsection.

A complete listing and description of the current input cards follow.

After these cards, a list of obsolete input cards, cards which are part of the constant data program but are currently not used, is provided in Table 3.3.

TABLE 3.1 OVERVIEW OF PROGRAM INPUTS

Card Order	Name
1	Header Card
2	Weapon ID Card
3	Round ID Card
4	ALW (Optional Input)
5	ALR (Optional Input)

Weapon/Round Data Cards — Weapon and/or Round Data Inputs Maximum Number of 16 of Each

Control Cards   N   ZZZ Card

For additional processing repeat the above, starting with Card 1

Last   XXX Card

3.2.1 Program Control Cards

In Table 3.2 a list and description of the program control cards which initiate execution of the constant data program is provided.

TABLE 3.2 PROGRAM CONTROL CARDS

Card Name	Comment
Header Card	Identifies information for data run
Weapon ID	Processes weapon system identification
Round ID	Processes round identification
ALW (Optional)	Allows weapon system overwrite
ALR (Optional)	Allows round overwrite
Constant data inputs (weapons and/or rounds)	
ZZZ	Starts processing
XXX	Stops processing

Header

For the purpose of subsequent user referral, each overall run receives a label or name. The contents of this card (up to 80 alphanumeric characters) becomes the run identifier information. The identification at the minimum should contain the following:

(1) Study name or code for which the data is generated.

(2) Date (month and year) data is added.

(3) Name of individual who prepares data.

(4) Data source identification, i.e., TR 207.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
					1
					2
					3
					4
					5
				8A10	6
					7
					8
					9
					10
					11
					12
					13
					14
					15
					16
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					80

NOTE:

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FIGURE 3.1 Header

Weapons ID

The program is capable of processing all or a portion of 16 overall weapon data records. This card specifies the number of weapons to be processed and the individual weapon identifiers (4 alphanumeric character names) appropriate for this run. Each weapon identifier is referred to as a weapon system constant data name by the AMSWAG model.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
					1
					2
				5X	3
					4
					5
Number of Rounds to be Processed, NWPN	1	0-16	NA	I2	6
					7
				3X	8
					9
					10
Identifier of Weapon 1, WPNLST (1)		NA	NA	A4	11
					12
					13
					14
Repeat of Columns 11-14					15
					16
					17
					18
					19
					20
					21
					22
					...
					80

NOTE:

1. If no weapons are to be processed, set equal to 0 or blank. Integer value must be right justified.

FIGURE 3.2   Weapons ID

16

Rounds ID

The program is capable of processing all or a portion of 16 overall round data records. This card specifies the number of rounds to be processed and the individual round identifiers (4 alphanumeric character names) appropriate for this run. Each round identifier is referred to as a round constant data name by the AMSWAG model.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
				5X	2–5
Number of Rounds to be Processed, NRND	1	0–16	NA	I2	6–9
				3X	10
Identifier of Round 1, RNDLST (1)		NA	NA	A4	11–14
Identifier of Round 2, RNDLST (2)		NA	NA	A4	15–18
.		.	.	.	19–22
.		.	.	.	23–26
.		.	.	.	27–30
.		.	.	.	31–34
.		.	.	.	35–38
.		.	.	.	39–42
					43–46
					47–50
.		.	.	.	51–54
.		.	.	.	55–58
.		.	.	.	59–62
.		.	.	.	63–66
.		.	.	.	67–70
Identifier of Round 16, RNDLST (16)		NA	NA	NA	71–74
					75–80

NOTE:

1. If no rounds are to be processed, set equal to 0 or blank. Integer value must be right justified.

FIGURE 3.3 Rounds ID

18

ALW - Weapon Data Overwrite

       This card is optional and should not be used for normal program execution. The purpose is to allow the user to overwrite existing incorrect weapon system estimates with correct estimates. New or improved estimates should be created with a new weapon system code name, thus leaving old data estimates available for possible use.

CARD TYPE: Weapon Data Overwrite

CARD SEQUENCE: Optional

NO. CARDS THIS TYPE: As Required Up to 16

NOTE:

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'ALW'	NA	A3	1–3
WPN ID to be assigned, IDWPN		NA	NA	A4	4–7
				3X	8–10
WPN ID to be over-written, IDWPNA		NA	NA	A4	11–14

FIGURE 3.4 Weapon Data Overwrite

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ALR - Round Data Overwrite

This card is optional and should not be used for normal program execution. The purpose is to allow the user to overwrite existing incorrect round estimates with correct estimates. New or improved estimates should be created with a new round code name, thus leaving old data estimates available for possible use.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'ALR'	NA	A3	1-3
RND ID to be assigned, IDRND		NA	NA	A4	4-7
				3X	8-10
RND ID to be overwritten, IDRNDA		NA	NA	A4	11-14

CARD TYPE: Round Data Overwrite

CARD SEQUENCE: Optional

NO. CARDS THIS TYPE: As Required Up to 16

NOTE:

FIGURE 3.5 Round Data Overwrite

22

ZZZ   Start Processing

This card provides a sentinel which specifies that all inputs for the run to be labeled per the "header card" have been provided, and then initiates the processing and storing of inputs. Estimates to be processed under another header card may be input next.

CARD TYPE: Start Processing

CARD SEQUENCE: Last Card Of Each Case

NO CARDS THIS TYPE: 1

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
					1
Card Title		'ZZZ'	NA	A3	2
					3
					4
					5
					6
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NOTE:

FIGURE 3.6 Start Processing

<u>XXX   Stop Processing</u>

This card terminates the Constant Data Program.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'XXX'	NA	A3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

NOTE:

FIGURE 3.7 Stop Processing

3.2.2 Weapon Data Cards

In Table 3.3 a list and description of the input cards which create a weapon system data record are provided. The order of the input cards is not important.

TABLE 3. 3   WEAPON DATA CARDS

Card Name	Comment
DIM	Weapon System Dimensions
MJ3	Maximum Range for Firing on the Move
MJ4	Weapon Code Conversion
MJ6	Maximum Range Weapon Will Fire
CRT[1]	Response Time Correction Factor for Moving Firer
KRT[1]	Response Time Correction Factor for Moving Target
M1A	Moving Firer Correction Dispersion, Terrain Type 1, Vel <55 K/H
M1B	Moving Firer Correction Dispersion, Terrain Type 1, Vel >55 K/H
MF2[1]	Moving Firer Correction Dispersion, Terrain Type II
MF3[1]	Moving Firer Correction Dispersion, Terrain Type III
M4A[1]	Moving Firer Correction Dispersion, Terrain Type IV, Vel <55 K/H
M4B[1]	Moving Firer Correction Dispersion, Terrain Type IV, Vel >55 K/H
MF5[1]	Moving Firer Correction Dispersion, Terrain Type V
MF6[1]	Moving Firer Correction Dispersion, Terrain Type VI

[1] Inputs not required for weapon types for which the vulnerability data estimates are read from expected time to kill (ETK) tables. ETK data estimates are furnished for rapid fire weapon systems and for single shot high explosive rounds.

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DIM — Weapon System Dimensions

Hull and turret dimensions of a weapon system are defined by rectangular measurements (height, width and length) as diagrammed below:
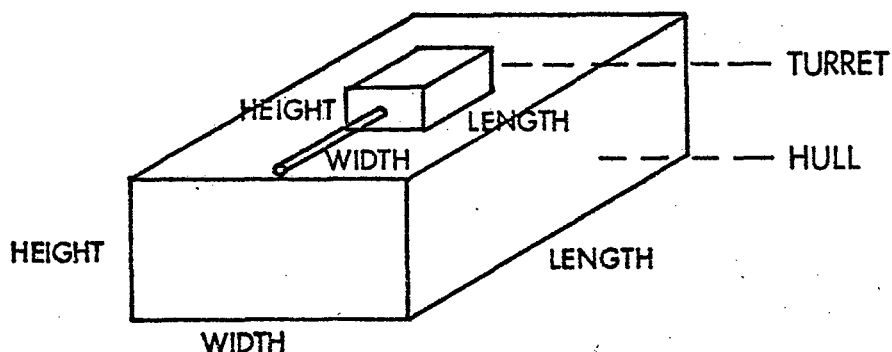
In the model the turret represents the presentation of the target when in a hull defilade status. Similarly, the turret and hull together represent the presentation of the target when in a fully exposed status.

Vulnerability estimates used by the model assume an actual presentation of the target in each a hull defilade and a fully exposed target case. Consequently, the presentation of a target as defined by the dimensions from this card should agree, as closely as possible, with the presentation assumed in the generation of the vulnerability estimates. It is therefore recommended that a silhouette drawing as furnished by the vulnerability program, and not by an engineering drawing, be used in determining target size.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'DIM'	NA	A3	1–3
Weapon Identifier, AWN		NA	NA	A4	4–10
Hull Height, DIMHH	1	0-99999	Centimeters	I5	11–15
Hull Width, DIMWH	1	0-99999	Centimeters	I5	16–20
Hull Length, DIMLH	.	.	.	.	21–25
Turret Height, DIMHT	.	.	.	.	26–30
Turret Width, DIMWT	.	.	.	.	31–35
Turret Length, DIMLT	1	0-99999	Centimeters	I5	36–40

NOTE: 1. See attached content page.

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FIGURE 3.8 Weapon System Dimensions

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MJ3 - Maximum Range for Firing on the Move

This card provides, for a specified moving weapon system, the maximum range above which the weapon system is not allowed to fire any rounds. A zero value implies that the weapon does not fire while moving.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'MJ3'	NA	A3	1, 2, 3
Weapon Identifier, AWN		NA	NA	A4	4, 5, 6, 7
					8, 9, 10
Maximum Range for Moving Firer		0-9999	Meters	I4	11, 12, 13, 14

NOTE:

FIGURE 3.9 Maximum Range for Firing on the Move

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MJ4 - Weapon Code Conversion

The use of this card replaces the weapon code name within a weapon data deck being loaded by a new name. The purpose of the card is to conveniently create a new weapon data record from an old weapon data deck without the necessity of correcting the old name on each card.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'MJ4'	NA	A3	1–3
Identifier for Old Weapon Name, OLD		NA	NA	A4	4–9
Identifier for New Weapon Name, NEW		NA	NA	A4	10–13

COL numbering: 1 through 80

CARD TYPE: Weapon Code Conversion

CARD SEQUENCE:

NO. CARDS THIS TYPE: As Required Up to 16

NOTE:

FIGURE 3.10 Weapon Code Conversion

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MJ6 - Maximum Range Weapon Can Fire

This card specifies, for a stationary weapon system, the maximum range above which the weapon system is not allowed to fire any rounds.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'MJ6'	NA	A3	1–3
Weapon Identifier, AWN		NA	NA	A4	4–7
Maximum Range for Weapon		0-9999	Meters	I4	8–11

NOTE:

FIGURE 3.11 Maximum Range Weapon Can Fire

CRT - Response Time Correction Factor For Moving Target

The first and subsequent variable response times for a round fired against a given moving target are obtained by the application of a multiplicative factor to the corresponding response times for the same round fired by a stationary firer against a stationary target. The factors, indexed on range, are provided with this card.

See Response Time (RVM, RTF, and MRT) cards.

KRT - Response Time Correction Factor For Moving Target

The first and subsequent variable response times for a round fired by a given moving firer are obtained by the application of a multiplicative factor to the corresponding response times for the same round fired by a stationary firer against a stationary target. The factors, indexed on range, are provided with this card.

See Response Time (RVM, RTF, and MRT) cards.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		As Approp	NA	A3	1-3
Weapon Identifier, AWN		NA	NA	A4	4-7
Correction Factor for 1st Round (1st Range Interval)	1	0-999	Hundredths	I3	8-10
Correction Factor for Subsequent Rounds (1st Range Interval)	1	0-999	Hundredths	I3	11-13
Correction Factor for 1st Round (2d Range Interval)	1	0-999	Hundredths	I3	14-16
Correction Factor for Subsequent Rounds (2d Range Interval)	1	0-999	Hundredths	I3	17-19
.	.	.	.	.	20-43
Correction Factor for 1st Round (7th Range Interval)	1	0-999	Hundredths	I3	44-46
Correction Factor for Subsequent Rounds (7th Range Interval)	1	0-999	Hundredths	I3	47-49
					50-80

NOTE:

1. First range is zero, range interval is specified on RDC card.

FIGURE 3.12 Response Time Correction Factor

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M1A - Moving Firer Correction Dispersions, Terrain Type I, Vel <55 KMPH

M1B - Moving Firer Correction Dispersions, Terrain Type I, Vel >55 KMPH, Vel <65 KMPH

MF2 - Moving Firer Correction Dispersions, Terrain Type II, Vel <55 KMPH

MF3 - Moving Firer Correction Dispersions, Terrain Type III, Vel >55 KMPH

M4A - Moving Firer Correction Dispersions, Terrain Type IV, Vel <55 KMPH

M4B - Moving Firer Correction Dispersions, Terrain Type IV, Vel >55 KMPH, Vel <65 KMPH

MF5 - Moving Firer Correction Dispersions, Terrain Type V, Vel <55 KMPH

MF6 - Moving Firer Correction Dispersions, Terrain Type VI, Vel <55 KMPH

Dispersion estimates for a round from a specified moving firer against a stationary target condition are obtained by add-on dispersion factors to the dispersion estimates for the same round for a stationary firer against a stationary target condition. Add-on horizontal and vertical dispersions are input as a function of vehicle speed for six terrain roughness classifications as follows:

Terrain Type I - Level farmland meadows

Terrain Type II - Fields with overpass roads

Terrain Type III - Frozen plowed fields with crossings

Terrain Type IV - Rolling meadows

Terrain Type V - Stony farmland with crossings

Terrain Type VI - Heavily used tank roads.

M1B and M4B cards continue M1A and M4A cards respectively for velocities up to 70 KMPH.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		As Approp	NA	A3	1-3
Weapon Identifier, AWN		NA	NA	A4	4-7
Dispersion in x-direction for velocity <5 KMPH		0-999	Hundredths of Mils	I3	8-10
Dispersion in y-direction for velocity <5 KMPH		0-999	Hundredths of Mils	I3	11-13
Dispersion in x-direction for velocity >5 but <10 KMPH		0-999	Hundredths of Mils	I3	14-16
Dispersion in y-direction for velocity >5 but <10 KMPH		0-999	Hundredths of Mils	I3	17-19
.	.	.	.	.	20-67
Dispersion in x-direction for velocity ≥ 50 but <55 KMPH		0-999	Hundredths of Mils	I3	68-70
Dispersion in y-direction for velocity ≥ 50 but <55 KMPH		0-999	Hundredths of Mils	I3	71-73
					74-80

NOTE: See Attached Sheet

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FIGURE 3.13 Moving Firer Correction Dispersions

40

3.2.3 Round Data Cards

In Table 3.4 a list and description of the input cards which create a round record are provided. The order of the input cards is not important.

TABLE 3.4   ROUND DATA CARDS

Title	Comment
RDC	Projectile velocity profile, maximum range, and data range interval.
DFO[1]	Stationary target dispersion, first round only.
DSH[1]	Stationary target dispersion, subsequent round after a hit.
DSM[1]	Stationary target dispersion, subsequent round after a miss.
MTO[1]	Moving target dispersion correction, near zero KMPH.
MT1[1]	Moving target dispersion correction, at 10 KMPH.
MT2[1]	Moving target dispersion correction, at 20 KMPH.
MT3[1]	Moving target dispersion correction, at 30 KMPH.
MT4[1]	Moving target dispersion correction, at 40 KMPH.
RVM[1]	Variable response time, median time to fire first/subsequent rounds.
RTF[1]	Fixed response time to fire first/subsequent rounds
MRT[1]	Minimum response time to fire first/subsequent rounds.
MJ5	Round code conversion
MJ7	Round maximum range for firing on the move.

[1] Inputs not required for round types for which the lethality estimates are read from expected time to kill (ETK) tables. ETK estimates are furnished for rapid fire weapon systems and for single shot high explosive rounds.

RDC   -   Projectile Velocity Profile, Maximum Range, and Data Range
              Interval

        This card, for a specified round, provides: projectile velocities, a
maximum effective range, and a data range interval. The projectile velocities
are given for 0, 500, . . ., 3000 meter ranges. Each velocity is calculated by
dividing the total range by the time of flight. The data range interval is
such that any data based upon the interval is defined at multiples of the interval.
As a cautionary note, the data range interval should agree with the interval
used in the processing and storage of vulnerability estimates.

        Two additional parameters which are defined on this card but no
longer used by AMSWAG are: pinpoint acquisition probability and round
reliability.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'RDC'	NA	A3	1-3
Round Identifier, ARD		NA	NA	A4	4-7
Round Velocity (1st range interval)	1	0-999	Meter/Sec	I4	8-11
Round Velocity (2nd range interval)	1	0-999	Meter/Sec	I4	12-15
.	.	.	.	.	16-20
.	.	.	.	.	21-24
.	.	.	.	.	25-28
.	.	.	.	.	29-32
Round Velocity (7th range interval)	1	0-999	Meter/Sec	I4	33-36
Pinpoint Acquisition Probability	2	0-99	% X 100	I2	37-43
Maximum Effective Range		0-999	Meters	I4	44-47
Round Reliability		0-99	% X 100	I2	48-50
Data Range Interval, INT	3	0-999	Meters	I3	51-80

NOTE:

1. First range interval is zero (muzzle velocity), range interval is specified on this card.
2. Not Used.
3. Default value equals 500 meters.

FIGURE 3.14 Projectile Velocity, Maximum Range, and Data Range Interval

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DFO - <u>Stationary target dispersion, first round only.</u>

DSH - <u>Stationary target dispersion, subsequent round given a hit.</u>

DSM - <u>Stationary target dispersion, subsequent round given a miss.</u>

This card provides horizontal and vertical dispersion estimates for a specified round for a stationary firer against a stationary target condition. The dispersions are indexed on range for either first round, subsequent round given a hit, or subsequent round given a miss.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		As Approp	NA	A3	1-3
Round Identifier, ARD		NA	NA	A4	4-7
Dispersion in x-direction (1st range interval)	1	0-9999	Hundredths of Mils	I4	8-11
Dispersion in x-direction (2nd range interval)	1	0-9999	Hundredths of Mils	I4	12-15
.	.	.	.	.	16-19
.	.	.	.	.	20-23
. .	.	.	.	.	24-27
.	.	.	.	.	28-31
Dispersion in x-direction (7th range interval)	.	0-9999	Hundredths of Mils	I4	32-35
Dispersion in y-direction (1st range interval)	1	0-9999	Hundredths of Mils	I4	36-39
Dispersion in y-direction (2nd range interval)	1	0-9999	Hundredths of Mils	I4	40-43
.	.	.	.	.	44-47
.	.	.	.	.	48-51
.	.	.	.	.	52-55
.	.	.	.	.	56-59
Dispersion in y-direction (7th range interval)	.	0-9999	Hundredths of Mils	I4	60-63
					64-80

NOTE:

1. Values are XX.XX mils (decimal point assumed), first range is zero, range interval is specified on RDC card.

FIGURE 3.15 Stationary Target Dispersions

<u>MT0 - Stationary firer to moving target dispersion corrections, Vel = 2 KMPH</u>

<u>MT1 - Stationary firer to moving target dispersion corrections, Vel = 10 KMPH</u>

<u>MT2 - Stationary firer to moving target dispersion corrections, Vel = 20 KMPH</u>

<u>MT3 - Stationary firer to moving target dispersion corrections, Vel = 30 KMPH</u>

<u>MT4 - Stationary firer to moving target dispersion corrections, Vel = 40 KMPH</u>

Dispersion estimates for a specified round for a stationary firer against a moving target condition are obtained by add-on dispersion factors to the dispersion estimates for the same round for a stationary firer against a stationary target condition. Add-on horizontal and vertical dispersions are input as a function of range for five target velocities.

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CARD TYPE: Stationary Firer to Moving Target Dispersion Corrections

CARD SEQUENCE: NA

NO. CARDS THIS TYPE: As Required Up to 16

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		As Approp	NA	A3	1-3
Round Identifier, ARD		NA	NA	A4	4-7
Dispersion in x-direction (1st range interval)	1	0-9999	Hundredths of Mils	I4	8-11
Dispersion in x-direction (2nd range interval)	1	0-9999	Hundredths of Mils	I4	12-15
.	.	.	.	.	16-19
.	.	.	.	.	20-23
.	.	.	.	.	24-27
.	.	.	.	.	28-31
Dispersion in x-direction (7th range interval)	.	0-9999	Hundredths of Mils	I4	32-35
Dispersion in y-direction (1st range interval)	1	0-9999	Hundredths of Mils	I4	36-39
Dispersion in y-direction (2nd range interval)	1	0-9999	Hundredths of Mils	I4	40-43
.	.	.	.	.	44-47
.	.	.	.	.	48-51
.	.	.	.	.	52-55
.	.	.	.	.	56-59
Dispersion in y-direction (7th range interval)	1	0-9999	Hundredths of Mils	I4	60-63
					64-80

NOTE:

1. Values are XX.XX mils (decimal point assumed), first range interval is zero, range interval is specified on RDC card.

FIGURE 3.16 Stationary Firer to Moving Target Dispersion Corrections

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RVM - Variable response time, median time to fire first/subsequent rounds

RTF - Fixed response time to fire first/subsequent rounds

MRT - Minimum response time to fire first/subsequent rounds

       This card, for a specified round, furnishes time to fire estimates for a stationary firer against a stationary target condition.

       The possible time to fire estimates and their definitions are as follows:

       Variable (median) response time - first round median time measured from the command "Gunner" to trigger pull. Subsequent round median time is after impact of first round with time of flight excluded.

       Fixed response time - subsequent round fixed time measured as a fixed waiting time before the variable (median) subsequent time begins.

       Minimum response time - subsequent round minimum time measured as a waiting period before the variable (median) subsequent time begins.

FIGURE 3.17 Response Times

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		As Approp	NA	A3	1 2 3
Round Identifier, ARD		NA	NA	A4	4 5 6 7
Response Time for 1st Round (1st range interval)	1	0-999	Tenths of Seconds	I3	8 9 10
Response time for subsequent rounds (1st range interval)	1	0-999	Tenths of Seconds	I3	11 12 13
Response time for 1st Round (2nd range interval)	1	0-999	Tenths of Seconds	I3	14 15 16
Response time for subsequent rounds (2nd range interval)	1	0-999	Tenths of Seconds	I3	17 18 19
..	.	.	.	.	20 21 22
	.	.	.	.	23 24 25
.	.	.	.	.	26 27 28
.	.	.	.	.	29 30 31
.	.	.	.	.	32 33 34
.	.	.	.	.	35 36 37
.	.	.	.	.	38 39 40
.	.	.	.	.	41 42 43
Response time for 1st Round (7th range interval)	1	0-999	Tenths of Seconds	I3	44 45 46
Response time for subsequent rounds (7th range interval)	1	0-999	Tenths of Seconds	I3	47 48 49
					50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

NOTE:

1. First range is zero, range interval is specified on RDC card.

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<u>MJ5   -   Round Code Conversion</u>

       The use of this card replaces the round code name within a
round data deck being loaded by a new name. The purpose of the card is
to conveniently create a new round data record from an old round data
deck without the necessity of correcting the old name on each card.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'MJ5"		A3	1–3
Identifier for old round name, OLD		NA	NA	A4	4–7
Identifier for new round name, NEW		NA	NA	A4	10–13

NOTE:

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FIGURE 3.18 Round Code Conversion

MJ7 - Round Maximum Range for Firing on the Move

This card, for a specified round fired from a moving weapon system, provides a maximum range above which the weapon system is not allowed to fire this round. A zero value implies that this round cannot be fired from a moving weapon system.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'MJ7'	NA	A3	1 2 3
Round Identifier, ARD		NA	NA	A4	4 5 6 7 8 9
Maximum Range of round when firer is moving		0-9999	Meters	I4	10 11 12 13

COL continues: 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

CARD TYPE: Round Maximum Range for Firing on the Move

CARD SEQUENCE: NA

NO. CARDS THIS TYPE: As Required Up to 16

NOTE:

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FIGURE 3.19 Round Maximum Range for Firing on the Move

TABLE 3.5 OBSOLETE CARDS

The following inputs are part of the constant data program but are no longer used.

Card Name	Comment
TDE	Weapon dimension (old format)
FTA	Factor for time to acquire
FSO	Pinpoint acquisition correction factors for stationary firer
FMO	Pinpoint acquisition correction factors for moving firer, <10 KMPH
FM1	Pinpoint acquisition correction factors for moving firer, <20 KMPH
FM2	Pinpoint acquisition correction factors for moving firer, <30 KMPH
FM3	Pinpoint acquisition correction factors for moving firer, <40 KMPH
FM4	Pinpoint acquisition correction factors for moving firer, >40 KMPH
MJ1	Artillery suppression factor
MJ2	Artillery vulnerability factor
BLD	Round choice priority

3.3 Output

3.3.1 Weapon Output

The primary output of the constant data program for each weapon is a random mass storage record consisting of 130 words. Weapon information is stored in only the first 119 words. The last 11 words are not used.

The first word, which forms a header for the record, is the alphanumeric weapon identifier code. The next four words are not used.

The remaining 113 words represent packed information. Each word consists of two quarterwords of 16 bits each.* In Table 3.6, a display of the packing scheme is given. Immediately after the table, a list of variable names used to label the appropriate quarterword in the packing scheme is defined. The proper unit for each variable is also provided.

---

*The notion of a word consisting of two quarterwords is confusing. The explanation is that, for the 1978 conversion of AMSWAG from the Ballistic Research Laboratory (BRL) 64 bit-word computer to a Control Data Collection (CDC) CYBER 76 60 bit-word computer, four quarterwords of a BRL word were stored into two successive CDC words.

TABLE 3.6 WEAPON DATA

First ¼ Word	1st ¼ Word	2nd ¼ Word	3rd ¼ Word	4th ¼ Word
1		Turret Width X	Turret Height Y	Turret Length Z
5	XMF(1,1)	XMF(2,1)	XMF(3,1)	XMF(4,1)
9	XMF(5,1)	XMF(6,1)	XMF(1,2)	XMF(2,2)
13	XMF(3,2)	XMF(4,2)	XMF(5,2)	XMF(6,2)
17	XMF(1,3)	XMF(2,3)	XMF(3,3)	XMF(4,3)
21	XMF(5,3)	XMF(6,3)	XMF(1,4)	XMF(2,4)
25	XMF(3,4)	XMF(4,4)	XMF(5,4)	XMF(6,4)
29	XMF(1,5)	XMF(2,5)	XMF(3,5)	XMF(4,5)
33	XMF(5,5)	XMF(6,5)	XMF(1,6)	XMF(2,6)
37	XMF(3,6)	XMF(4,6)	XMF(5,6)	XMF(6,6)
41	XMF(1,7)	XMF(2,7)	XMF(3,7)	XMF(4,7)
45	XMF(5,7)	XMF(6,7)	XMF(1,8)	XMF(2,8)
49	XMF(3,8)	XMF(4,8)	XMF(5,8)	XMF(6,8)
53	XMF(1,9)	XMF(2,9)	XMF(3,9)	XMF(4,9)
57	XMF(5,9)	XMF(6,9)	XMF(1,10)	XMF(2,10)
61	XMF(3,10)	XMF(4,10)	XMF(5,10)	XMF(6,10)
65	XMF(1,11)	XMF(2,11)	XMF(3,11)	XMF(4,11)
69	XMF(5,11)	XMF(6,11)	RTFMT1(1)	RTFMT1(2)
73	RTFMT1(3)	RTFMT1(4)	RTFMT1(5)	RTFMT1(6)
77	RTFMT1(7)	RTFMF1(1)	RTFMF1(2)	RTFMF1(3)

TABLE 3. 6 WEAPON DATA (Continued)

First ¼ Word #	1st ¼ Word	2nd ¼ Word	3rd ¼ Word	4th ¼ Word
81	RTFMF1(4)	RTFMF1(5)	RTFMF1(6)	RTFMF1(7)
85	PPF(1)	PPF(2)	PPF(3)	PPF(4)
89	PPF(5)	PPF(6)	PPF(7)	PPSF(1,1)
93	PPSF(2,1)	PPSF(3,1)	PPSF(4,1)	PPSF(5,1)
97	PPSF(1,2)	PPSF(2,2)	PPSF(3,2)	PPSF(4,2)
101	PPSF(5,2)	PPSF(1,3)	PPSF(2,3)	PPSF(3,3)
105	PPSF(4,3)	PPSF(5,3)	PPSF(1,4)	PPSF(2,4)
109	PPSF(3,4)	PPSF(4,4)	PPSF(5,4)	PPSF(1,5)
113	PPSF(2,5)	PPSF(3,5)	PPSF(4,5)	PPSF(5,5)
117	PPSF(1,6)	PPSF(2,6)	PPSF(3,6)	PPSF(4,6)
121	PPSF(5,6)	PPSF(1,7)	PPSF(2,7)	PPSF(3,7)
125	PPSF(4,7)	PPSF(5,7)		
129			RTFMTS(1)	RTFMTS(2)
133	RTFMTS(3)	RTFMTS(4)	RTFMTS(5)	RTFMTS(6)
137	RTFMTS(7)	RTFMFS(1)	RTFMFS(2)	RTFMFS(3)
141	RTFMFS(4)	RTFMFS(5)	RTFMFS(6)	RTFMFS(7)
145	YMF(1,1)	YMF(2,1)	YMF(3,1)	YMF(4,1)
149	YMF(5,1)	YMF(6,1)	YMF(2,1)	YMF(2,2)

TABLE 3.6   WEAPON DATA (Continued)

First ¼ Word #	1st ¼ Word	2nd ¼ Word	3rd ¼ Word	4th ¼ Word
153	YMF(3,2)	YMF(4,2)	YMF(5,2)	YMF(6,2)
157	YMF(1,3)	YMF(2,3)	YMF(3,3)	YMF(4,3)
161	YMF(5,3)	YMF(6,3)	YMF(1,4)	YMF(2,4)
165	YMF(3,4)	YMF(4,4)	YMF(5,4)	YMF(6,4)
169	YMF(1,5)	YMF(2,5)	YMF(3,5)	YMF(4,5)
173	YMF(5,5)	YMF(6,5)	YMF(1,6)	YMF(2,6)
177	YMF(3,6)	YMF(4,6)	YMF(5,6)	YMF(6,6)
181	YMF(1,7)	YMF(2,7)	YMF(3,7)	YMF(4,7)
185	YMF(5,7)	YMF(6,7)	YMF(1,8)	YMF(2,8)
189	YMF(3,8)	YMF(4,8)	YMF(5,8)	YMF(6,8)
193	YMF(1,9)	YMF(2,9)	YMF(3,9)	YMF(4,9)
197	YMF(5,9)	YMF(6,9)	YMF(1,10)	YMF(2,10)
201	YMF(3,10)	YMF(4,10)	YMF(5,10)	YMF(6,10)
205	YMF(1,11)	YMF(2,11)	YMF(3,11)	YMF(4,11)
209	YMF(5,11)	YMF(6,11)	Hull Width	Hull Height
213	Hull Length			
217		RMF	RMAX	
221	XMF(1,12)	XMF(1,13)	XMF(4,12)	XMF(4,13)
225	YMF(1,12)	YMF(1,13)	YMF(4,12)	YMF(4,13)

LIST OF VARIABLES FOR TABLE 3.6

XMF(i,j) - moving firer correction dispersions in x-direction for
terrain type i, velocity interval j, i=1, . ., 6, j=1, . ., 11
(mils x 100)

YMF(i,j) - moving firer correction dispersions in y-direction for
terrain type i, velocity interval j, i=1 . ., 6, j=1, . ., 11
(mils x 100)

RMF - maximum range for moving firer (meters)

RMAX - maximum range for stationary firer (meters)

Hull Width - See the DIM card (centimeters)

Hull Height - See the DIM card (centimeters)

Hull Length - See the DIM card (centimeters)

RTFMTS(i) - response time correction factor for moving target, subsequent
round, for range interval i, i=1, . ., 7 (% x 100)

RTFMFS(i) - response time correction factor for moving firer, subsequent
round, for range interval i, i=1, . ., 7 (% x 100)

RTFMT1(i) - response time correction factor for moving target, first round,
for range interval i, i=1, . ., 7 (% x 100)

RTFMF1(i) - response time correction factor for moving firer, first round,
for range interval i, i=1, . ., 7 (% x 100)

Turret Width - See the DIM card (centimeters)

Turret Height - See the DIM card (centimeters)

Turret Length - See the DIM card (centimeters)

PPF - Obsolete pinpoint acquisition factors (% x 100)

PPSF - Obsolete pinpoint acquisition factors (% x 100)

3.3.2 Round Output

The primay output of the constant data program for each round is a random mass storage record consisting of 130 words. Round information is stored in only the first 86 words. The last 44 words are not used.

The first two words, which form a header for the record, are the alphanumeric round identifier code and the range interval for the data, respectively.

The remaining 84 words represent packed information. Each word, with one exception, consists of two quarterwords of 16 bits each. (See the footnote at the beginning of Section 3.3) In Table 3.7, a display of the packing scheme is given. Immediately after the table, a list of variable names used to label the appropriate quarterword in the packing scheme is defined. The proper unit for each variable is also provided.

TABLE 3.7 ROUND DATA

First ¼ Word #	1st ¼ Word	2nd ¼ Word	3rd ¼ Word	4th ¼ Word
1	RT1(1)	RT1(2)	RT1(3)	RT1(4)
5	RT1(5)	RT1(6)	RT1(7)	RTFX1(1)
9	RTFX1(2)	RTFX1(3)	RTFX1(4)	RTFX1(5)
13	RTFX1(6)	RTFX1(7)	RTMN1(1)	RTMN1(2)
17	RTMN1(3)	RTMN1(4)	RTMN1(5)	RTMN1(6)
21	RTMN1(7)	VPRJ(1)	VPRJ(2)	VPRJ(3)
25	VPRJ(4)	VPRJ(5)	VPRJ(6)	VPRJ(7)
29	XMD(1,1)	XMD(2,1)	XMD(3,1)	XMD(4,1)
33	XMD(5,1)	XMD(1,2)	XMD(2,2)	XMD(3,2)
37	XMD(4,2)	XMD(5,2)	XMD(1,3)	XMD(2,3)
41	XMD(3,3)	XMD(4,3)	XMD(5,3)	XMD(1,4)
45	XMD(2,4)	XMD(3,4)	XMD(4,4)	XMD(5,4)
49	XMD(1,5)	XMD(2,5)	XMD(3,5)	XMD(4,5)
53	XMD(5,5)	XMD(1,6)	XMD(2,6)	XMD(3,6)
57	XMD(4,6)	XMD(5,6)	XMD(1,7)	XMD(2,7)
61	XMD(3,7)	XMD(4,7)	XMD(5,7)	XDISH(1)
65	XDISH(2)	XDISH(3)	XDISH(4)	XDISH(5)

TABLE 3.7 ROUND DATA (Continued)

First ¼ Word #	1st ¼ Word	2nd ¼ Word	3rd ¼ Word	4th ¼ Word
69	XDISH(6)	XDISH(7)	XDISM(1)	XDISM(7)
73	XDISM(3)	XDISM(4)	XDISM(5)	XDISM(6)
77	XDISM(7)	XDIS1(1)	XDIS1(2)	XDIS1(3)
81	XDIS1(4)	XDIS1(5)	XDIS1(6)	XDIS1(7)
85	RTOP	RTS(1)	RTS(2)	RTS(3)
89	RTS(4)	RTS(5)	RTS(6)	RTS(7)
93	RTFXS(1)	RTFXS(2)	RTFXS(3)	RTFXS(4)
97	RTFXS(5)	RTFXS(6)	RTFXS(7)	RTMNS(1)
101	RTMNS(2)	RTMNS(3)	RTMNS(4)	RTMNS(5)
105	RTMNS(6)	RTMNS(7)	YDISH(1)	YDISH(2)
109	YDISH(3)	YDISH(4)	YDISH(5)	YDISH(6)
113	YDISH(7)	YDISM(1)	YDISM(2)	YDISM(3)
117	YDISM(4)	YDISM(5)	YDISM(6)	YDISM(7)
121	YDIS1(1)	YDIS1(2)	YDIS1(3)	YDIS1(4)
125	YDIS1(5)	YDIS1(6)	YDIS1(7)	YMD(1,1)
129	YMD(2,1)	YMD(3,1)	YMD(4,1)	YMD(5,1)

TABLE 3.7 ROUND DATA (Continued)

First ¼ Word #	1st ¼ Word	2nd ¼ Word	3rd ¼ Word	4th ¼ Word
129	YMD(2,1)	YMD(3,1)	YMD(4,1)	YMD(5,1)
133	YMD(1,2)	YMD(2,2)	YMD(3,2)	YMD(4,2)
137	YMD(5,7)	YMD(1,3)	YMD(2,3)	YMD(3,3)
141	YMD(4,3)	YMD(5,3)	YMD(1,4)	YMD(2,4)
145	YMD(3,4)	YMD(4,4)	YMD(5,4)	YMD(1,5)
149	YMD(2,5)	YMD(3,5)	YMD(4,5)	YMD(5,5)
153	YMD(1,6)	YMD(2,6)	YMD(3,6)	YMD(4,6)
157	YMD(5,6)	YMD(1,7)	YMD(2,7)	YMD(3,7)
161	YMD(4,7)	YMD(5,7)	MOVING MAX RG, RNDREL	PA1

LIST OF VARIABLES FOR TABLE 3. 7

Firing Times, First Round

RT1(i) - variable response time, first round, for range interval i, i=1, . . ., 7 (seconds x 10)

RTFX1(i) - fixed response time, first round, for range interval i, i=1, . . ., 7 (seconds x 10)

RTMN1(i) - minimum response time, first round, for range interval i, i=1, . . ., 7 (seconds x 10)

Round Velocities

VPRJ(i) - projectile velocity for range interval i, i=1, . . ., 7 (meters/second)

Lateral Dispersions

XDIS1(i) - stationary target x-dispersion, first round only, for range interval i, i=1, . . ., 7 (mils x 100)

XDISH(i) - stationary target x-dispersion, subsequent round given a hit, for range interval i, i=1, . . ., 7 (mils x 100)

XDISM(i) - stationary target x-dispersion, subsequent round, given a miss, for range interval i, i=1, . . ., 7 (mils x 100)

Firing Times, Subsequent Rounds

RTS(i) - variable response time, subsequent rounds, for range interval i, i=1, . . ., 7 (seconds x 10)

RTFXS(i) - fixed response time, subsequent rounds, for range interval i, i=1, . . ., 7 (seconds x 10)

RTMNS(i) - minimum response time, subsequent rounds, for range interval i, i=1, . . ., 7 (seconds x 10)

Vertical Dispersions

YDIS1(i) - stationary target y-dispersion, first round only, for range interval i, i=1, . ., 7 (mils x 100)

YDISH(i) - stationary target y-dispersion, subsequent round, given a hit, for range interval i, i=1, . . ., 7 (mils x 100)

YDISM(i) - stationary target y-dispersion, subsequent round, given a miss, for range interval i, i=1, . . ., 7 (mils x 100)

Adjustments to Dispersions

XMD(i,j) - add-on x-dispersion data (to the stationary versus stationary data) for the stationary versus moving data for velocity value i, i=1, . . .,5 and range interval j, j=1, . . .,7 (mils x 100)

YMD(i,j) - add-on y-dispersion data (to the stationary versus stationary data) for the stationary versus moving data for velocity value i, i=1, . . ., 5, and range interval j, j=1,. . . . 7 (mils x 100)

Miscellaneous

RTOP - maximum effective range (meters)

MOVING MAX RG - maximum effective range for moving firer (meters ÷ 25)

RNDREL - round reliability; no longer used (% x 100)

PA1 - pinpoint acquisition probability; no longer used (% x 100)

4. VULNERABILITY (SINGLE SHOT) PREPROCESSOR PROGRAM

4.1 General Description

The vulnerability (single shot) preprocessor program reads probability of kill given a hit ($P_{K/H}$) estimates and then converts these estimates into random mass storage files directly accessable by the AMSWAG main model. The $P_{K/H}$ estimates are normally a function of kill criterion, range, target exposure, and attack azimuth angle.

4.2 Input

The program actually reads two types of formatted files: a data file and a data management file. A data file, normally not prepared by a user of the program but instead by the Vulnerability Laboratory (VL) of the Ballistic Research Laboratory, contains the $P_{K/H}$ estimates. A data management file, prepared by a user, contains information which allows the preprocessor program to correctly identify and read a data file.

4.2.1 $P_{K/H}$ Data File

The organization of the input cards for a data file is described in Table 4.1. The first type of input card, displayed in Figure 4.1, contains the VL file number and the number of data cards that follow. The second type of card, displayed in Figure 4.2, contains the $P_{K/H}$ estimates.

4.2.2 Data Management File

The organization of the input cards for a data management file is described in Table 4.2. The first type of input card, displayed in Figure 4.3, contains the identification number of the desired data file. The second type of card, displayed in Figure 4.4, contains the code names of a round and weapon for a desired round/weapon combination.

TABLE 4.1 ORGANIZATION OF A DATA FILE

Card Number	Card Type
1	ID (File Number; Card Count = N1)
2	Data Cards
N1 .	" "
:	
N1 + 1	ID (File Number; Card Count = N2)
N1 + 2	Data Cards
N2 :	
N1 + N2 + 1	
	ID (FIle Number; Card Count = N3)
N3 :	Data Cards
Etc.	

NOTE: Data estimate sets are typically added as they become available during the course of round and/or weapon development.

Basic Data ID

   This card typically accompanies the basic data estimates furnished
by the Vulnerability Laboratory of the Ballistic Research Laboratory.
The file identification is a serial number assigned by the originator
of the estimates for internal bookkeeping.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
					1
File ID, NOFILE		1 to 9999	NA	I4	2
					3
					4
					5
No. of Data Cards to	1	88, 110			6
Follow, NCARDS		616, 770	NA	I4	7
					8
					9
					10
					11
					12
					13
					14
					15
					16
					17
					18
					19
					20
					21
					22
					23
					24
					25
					26
					27
					28
					29
					30
					31
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					61
					62
					63
					64
					65
					66
					67
					68
					69
					70
					71
					72
					73
					74
					75
					76
					77
					78
					79
					80

CARD TYPE: Basic Data ID

CARD SEQUENCE: First Card of Each Set

NO. CARDS THIS TYPE: 1 Per Set

NOTE:

1. Other values are possible but unlikely.

FIGURE 4.1   BASIC DATA ID

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Basic Data

This card contains the probability of kill given a hit $(P_{K/H})$ estimates. The estimates are a function of up to five kill criteria, seven ranges, eleven dispersions, and eight attack azimuth angles. In current practice, the program reads only the estimates corresponding to the cardioid average of these angles.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Target Identification		1 to 9999	NA	I4	1–4
Round Identification		1 to 9999	NA	I4	5–8
				1X	9
Range, IR	1	0 to 3000 or 9999	Meters	I4	10–14
Exposure, IX	2	1 or 2	NA	I1	15
Impact (Hit) Dispersion, IDN	3	1 to 11	Feet	I2	16–18
Kill Criterion, IK		M,F,M/F,K,EC	NA	I1	19–21
Probability of Kill given a hit for an attack azimuth of 0° (head-on), ZETB		0 to 1.0	None	F6.3	22–27
Same as 22-27 for a 30° azimuth, ZETB					28–33
Same as 22-27 for a 60° azimuth, ZETB					34–39
Same as 22-27 for a 90° azimuth, ZETB					40–45
Same as 22-27 for a 120° azimuth, ZETB					46–51
Same as 22-27 for a 150° azimuth, ZETB					52–57
Same as 22-27 for a 180° azimuth, ZETB					58–63
Probability of Kill given a hit averaged over the angles in cols. 22-63, CRTVUL	4	0 to 1.0	None	F6.3	64–69
					70–80

NOTE:

1. If the round performance is not dependent on range the flag 9999 should be used.
2. 1=fully exposed; 2=hull defilade.
3. The 11th value represents the probability of kill for a random hit at the specified angles.
4. The weighting scheme usually employed results in this being called the cardioid average.

FIGURE 4.2 BASIC DATA

TABLE 4.2   ORGANIZATION OF A DATA MANAGEMENT FILE

	Card Number		Card Type
Set 1	1		Raw Data Locator (ID) #1
	2		Data Control Card (DC) #1
Set 2	3		ID #2
	4		DC #2
	⋮		
	N-1		ID #N
Set N/2	N		DC #N
	N+1		End of Input Sentinel

NOTE: 1. N is an even integer.

Raw Data Locator

This card specifies the serial number of the data file which contains the vulnerability estimates to be loaded. It is one of the two cards that identify the data to be loaded.

Any negative number in cols 1-4 causes a normal termination of the loading process; "-999" is normally used.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
File Number Containing Data to be loaded, FILENO	1	1 to 9999	NA	I4	1–80

NOTE:

1. "-999" is used as an end of run sentinel; however, any negative integer will work as well.

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FIGURE 4.3 RAW DATA LOCATOR

Data Control

This card supplies the alphanumeric round and weapon code names and the range increment corresponding to the desired probability of kill given a hit ($P_{K/H}$) estimates.

If the data being loaded are to replace previously loaded data, then the obsolete round and weapon codes are also supplied.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
AMSWAG Round Code, RDNCD		XXXX	NA	A4	1–4
				6X	5–10
AMSWAG Weapon Code, WPNCD		XXXX	NA ·	A4	11–14
				6X	15–20
Range Increment, RNGINC	1	0 to 9999	Meters	I10	21–30
Obsolete Round Code, DRSCRND	2	XXXX	NA	A4	31–34
				6X	35–40
Obsolete Weapon Code, DSCWPN	2	XXXX	NA	A4	41–44

COL column numbered 1 through 80.

CARD TYPE: Data Control

CARD SEQUENCE: Second Card of Two/Set

NO. CARDS THIS TYPE: 1 Per Set

NOTE:
1. If blank or 0, an increment of 500 meters is assumed.
2. Optional; infrequently used.

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FIGURE 4.4   DATA CONTROL

4.3 Output

The primary output of the vulnerability preprocessor program is, for each kill criterion, a set of one to three random mass storage files. Each record of a file contains the vulnerability information for a round-weapon combination of interest.

The first two words of a record are the alphanumeric round code and weapon code of a round-weapon combination. The third word, an integer equal to 2*NVAL, where NVAL=1, 11, or 77, is the number of packed words containing vulnerability information in the record. The fourth word is an integer equal to 192, 224, or 240. The number of ones in the binary representation of this integer represents the number of parameters influencing the vulnerability values. As an example, the three ones in the integer 224 (= 1110 0000) represents the three parameters exposure, aspect angle, and dispersion.

The remaining 5th to the $(5+2*NVAL-1)^{th}$ words contain the packed vulnerability information. Each of these words contains four bytes, with each byte eight bits long as follows:

BYTE 1	BYTE 2	BYTE 3	BYTE 4	

59   52 51   44 43   36 35   28 27   0
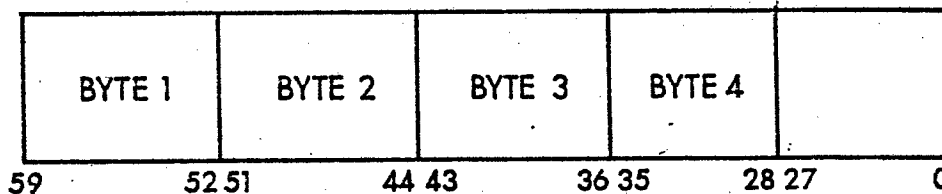
Bit number (from right of word)

Each byte represents a vulnerability value (a probability) multiplied by 256 (=2^8) and then added to .5.

As an aid to the reader in the following discussion of word and byte location, the notation (R_i, D_J, A_k, E_1) denotes the byte corresponding to the ith range, j^{th} dispersion, k^{th} aspect angle, and 1th exposure.

For fixed range i and dispersion j, the $5+2^*((D_j-1) + (R_i-1)^*NDISP)^{th}$ word, where NDISP is the number of dispersions, contains the four bytes corresponding to the set:

$$(R_i, D_j, A_k, E_1) \quad : \quad 1 = 1,2; \ k=1,2$$

and arranged as follows:

(R_i,D_j,A_1,E_1)	(R_i,D_j,A_1,E_2)	(R_i,D_j,A_2,E_1)	(R_i,D_j,A_2,E_2)	
1	2	3	4	

Similarly, for fixed range i and dispersion j, the $5+2^*((D_j-1) + (R_i-1)^*NDISP) + 1^{th}$ word contains the four bytes corresponding to the set

$$(R_i, D_j, A_k, E_1) \quad 1=1,2; \ k=3,4$$

and arranged as follows:

(R_i,D_j,A_3,E_1)	(R_i,D_j,A_3,E_2)	(R_i,D_j,A_4,E_1)	(R_1,D_j,A_4,E_2)	
5	6	7	8	

In other words, the above two successive words contain the eight bytes of vulnerability information for i^{th} range and j^{th} dispersion.

A second output of the program is the following printed data:

(1) Maximum number of records already in each vulnerability mass storage file (once per run).

(2) File number and card event, from the data file (once each card).

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(3)   Round and target identifier and the AMSWAG file type (11 for rounds which depend upon dispersion but not range and 77 for rounds which depend upon both).

(4)   A list of the processed tape files and the number of cards containing valid estimates.

The information in items (2) - (4) is repeated for each additional set of input data.

5. EXPECTED TIME TO KILL (BURST FIRE) PROGRAM

5.1 General Description

The expected time to kill (burst fire) preprocessor program reads vulnerability estimates and converts the estimates into random mass storage files.

The vulnerability estimates, primarily for burst-fire type weapons such as a machine gun, are divided into "hard" (vehicle) target type estimates and "soft" (personnel) target type estimates. The first type of estimates is subdivided according to a firepower (F), mobility (M), or mobility or firepower (M/F) kill criterion of the target. The estimates consist of expected time to kill (ETK) and expected number of rounds (ER). The second type of estimates is subdivided according to personnel outside of a vehicle (P) or personnel inside a vehicle (EC) kill criterion. These estimates consist of expected time to kill 70% of the personnel (ET70), expected rate of fire (ERPS), and an attrition factor (EL).

5.2 Input

The program requires input consisting of an identification type data card, data cards, and sentinel cards. A kill criterion entry on the identification card indicates type of data.

The organization of the input cards for the "hard" target estimates is described in Table 5.1. The identification, data, and sentinel cards are described in Figures 5.1 through 5.4.

The organization of the input cards for the "soft" target estimates and the content of the identification and sentinel cards are exactly the same as for that of the "hard" target estimates. Consequently, only the data cards, which are different, are described in Figure 5.5.

TABLE 5.1 ET/ER TYPICAL INPUT ORGANIZATION

Card Order	Card Type							
1	ID	M-Kill						
2	ET/ER	Ranges	1-4	ST	SF	HD		1
3	"	"	5-8	ST	SF	HD		2
4	"	"	1-4	ST	SF	FE		1
5	"	"	5-8	ST	SF	FE	-	2
6	"	"	1-4	ST	MF	HD		1
7	"	"	5-8	"	"	"		2
8	"	"	1-4	"	"	FE		1
9	"	"	5-8	"	"	"		2
10	"	"	1-4	MT	SF	HD		1
11	"	"	5-8	"	"	"		2
12	"	"	1-4	"	"	FE		1
13	"	"	5-8	"	"	"		2
14	"	"	1-4	"	MF	HD		1
15	"	"	5-8	"	"	"		2
16	"	"	1-4	"	"	FE		1
17	"	"	5-8	"	"	"		2
18	"LAST"							
19	ID	F Kill						
⋮								
35	ET/ER	"	5-8	MT	MF	FE		2
36	"LAST"							
⋮								
N	"LAST"							
N+1	"DONE"							

NOTE: Definition of Symbols:

    ST - Stationary Target
    SF - Stationary Firer
    MT - Moving Target
    MF - Moving Firer
    HD - Target in hull defilade posture
    FE - Target in fully exposed posture

Identification

This card supplies the alphanumeric round and weapon code names of the desired round-target combination, kill criterion (which determines data type), rate of fire scale factor, and range interval. If the estimates being loaded are to replace previously loaded estimates, then the obsolete round and weapon codes are also supplied.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Round Identification, IRD		NA	NA	A4	1–4
				2X	5–6
Weapon Identification, IWN		NA	NA	A4	7–10
				2X	11–12
Kill Criteria, KILL	1	F, M, M/F EC, P	NA	A3	13–15
				2X	16–17
ERPS Scale Factor Code, KERPS	2	H or Blank	NA	A1	18
				3X	19–21
Range Interval, IRG		1 to 9999	Meters	I4	22–25
				10X	26–35
Date, IDATE	3	NA	NA	A10	36–45
				5X	46–50
User's Code, IMISC		NA	NA	A10	51–60
				10X	61–70
Obsolete Round Identification, OBSRD	4,5	NA	NA	A4	71–74
				2X	75–76
Obsolete Wpn Identification, OBSWPN	4,5	NA	NA	A4	77–80

NOTE:

1. F implies Fire Power Kill, M implies Mobility Kill, M/F implies Fire Power or Mobility Kill, EC implies Expected Casualties in vehicle, and P implies Personnel (dismounted) Kill.

2. The normal scale factor for the rate of fire data (EC or P) is sixths; for low rate systems, hundredths are used (if the letter "H" appears in col. 18. This flag only applies to ET70/ERPS/EL estimates.

3. If no date is punched in this field, the date on which the problem is run is used.

4. Inserting an obsolete Rd/Wpn combination identification in col. 71 through 80 exercises an option which replaces the present information with the estimates presented for this run and renames it with the ID information in col. 1 through 10.

5. If estimates for an existing Rd/Wpn combination are to be updated, fill out the ID card as usual and insert "UPDATE" in Col. 75-80.

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ET/ER Data

The ET/ER card provides the expected time to kill (ET) and expected number of rounds (ER) estimates. Each card is indexed on target mobility code (target stationary or moving), firer mobility code (firer stationary or moving), exposure code (target in hull defilade or fully exposed status), and range set number (first four range increments or second four range increments).

The ET and ER estimates are entered in multiples of tenths. Thus, an ET value of 10.5 seconds is entered as 105; an ER value of 5 rounds is entered as 50.

CARD TYPE: Data: ET/ER

CARD SEQUENCE: After ID Card

NO. CARDS THIS TYPE: 0 to 16

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Expected Time to Kill, ET	1,2	1 to 99999	Tenths of Seconds	I5	1–5
Expected Rounds to Kill, ER	2	1 to 99999	Tenths of Seconds	I5	6–10
				5X	11–15
Repeat of 1-15					16–30
Repeat of 1-15					31–45
Repeat of 1-15					46–60
				10X	61–70
Target Mobility Code	3	ST or MT	NA	A2	71–72
Firer Mobility Code	4	SF or MF	NA	A2	74–75
Exposure Code	5	HD or FE	NA	A2	77–78
Range Set Number	6	1-2	NA	1X / I1	79–80

NOTE:

1. Each card of this type provides the ET/ER data (15 col groups) for four ranges. See note 5
2. Stationary target (ST) or moving target (MT)
3. Stationary firer (SF) or moving firer (MF)
4. Hull Defilade (HD) or Fully Exposed (FE) Exposure.
5. 1 implies first set of four ranges, starting at 0 and incremented by the range interval; 2 implies the second set of four ranges.

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FIGURE 5.2   Data: ET/ER

End Sentinel for Case

The sentinel for the end of a particular case is provided with this card.

CARD TYPE: End Sentinel for Case **CARD SEQUENCE:** Last Card of Each Case **NO. CARDS THIS TYPE:** 1 Per Case

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'LAST'	NA	A4	1–80

NOTE:

FIGURE 5.3   End Sentinel for Case

End Sentinel for Run

The sentinel for the end of a run is provided with this card.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Card Title		'DONE'	NA	A4	1–80

NOTE:

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FIGURE 5.4   End Sentinel for Run

ET70/ERPS/EL Data

These cards are supplied for the two kill criteria P (personnel) and EC (expected casualties), associated with primarily personnel targets and targets for which casualty counts are important (e.g., the squad in an armored personnel carrier which may become unavailable for a subsequent dismount or which may have a cost or logistical impact on the assessment of outcome).

ET70, the expected time to attrit 70% of the personnel, is input in tenths of a second; thus 5 seconds is input as the integer 50. The rate of fire (ERPS) is input in thousandths of rounds/second; thus 2 rounds/second is input as 2000. These estimates are stored according to the ERPS option specified on the ID card. The attrition coefficient, EL, is input in multiples of ten thousandths; thus 1.0 is input as 10,000; .005 as 50, etc.

ITEM DESCRIPTION	NOTE	LIMITS	UNITS	FORMAT	COL
Time to Kill 70% of Target, ET70	1-5	NA	Tenths of Seconds	I5	1-5
Rate of Fire, ERPS		NA	Thousandths of Rounds Per Second	I5	6-10
Lambda, EL		NA	Ten Thousandths	I5	11-15
Repeat of 1-17					
Repeat of 1-17					
Repeat of 1-17				2X	69
Same as ET/ER Data Card					

NOTE:

1 to 5. Same general notes as given for ET/ER Data Cards.

FIGURE 5.5 ET Data: ET70/ERPS/EL

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5.3 Output

The primary output of the expected time to kill preprocessor
program is, for each kill criterion, a random mass storage file.
Each record of a file contains vulnerability information for a
round-weapon combination of interest.

The first four words of a record give identification infor-
mation. The packed first word contains the alphanumeric round and
target codes, scale factors for rate of fire, and a flag for a personnel
target. It is arranged as follows:

ROUND	SCALE FACTOR	FLAG FOR PERSONNEL TARGET	TARGET
A4	A1	A1	A4
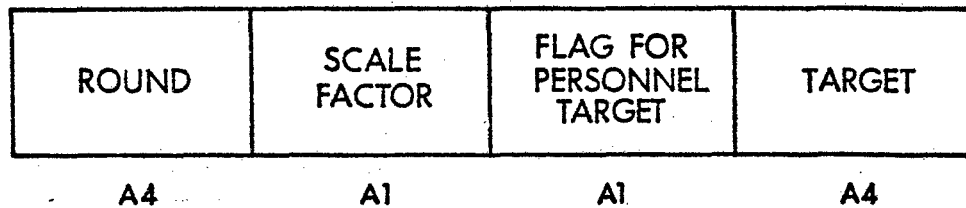
The second word contains the integer 15 and the range interval
and is arranged as follows:

15	RANGE

59   30 29   0

Bit Number
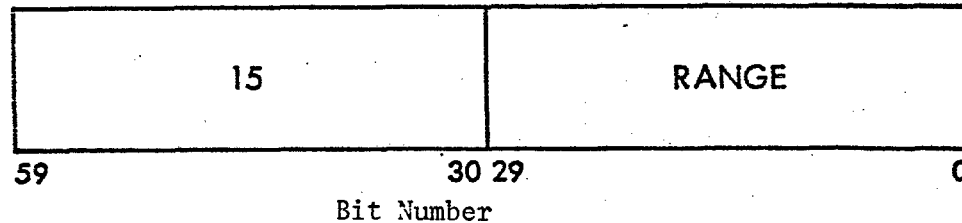
The third and fourth words contain nonessential identification
information such as a date and user code.

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In the discussion of the remaining words, let C_i, i=1,2,...8 denote the following combinations of the movement status of the target, movement status of the firer, and exposure status of the target:

$$
\begin{array}{llll}
C_1 & = ST & SF & HD \\
C_2 & = ST & SF & FE \\
C_3 & = ST & MF & HD \\
C_4 & = ST & MF & FE \\
C_5 & = MT & SF & HD \\
C_6 & = MT & SF & FE \\
C_7 & = MT & MF & HD \\
C_8 & = MT & MF & FE \\
\end{array}
$$

Where:

ST = Stationary Target

MT = Moving Target

SF = Stationary Firer
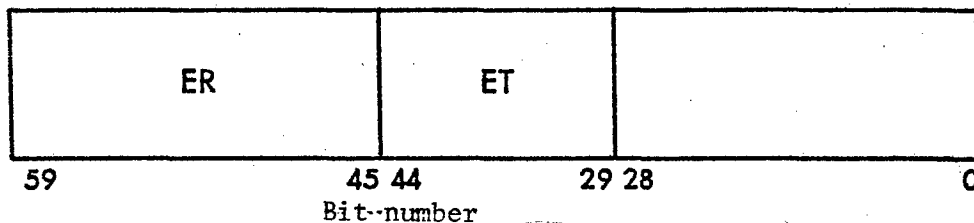
MF = Moving Firer

HD = Hull Defilade Exposure

FE = Full Exposure

Also, let R_j, j=1,2,...8 denote the jth range increment.

If the estimates are for "hard" targets, then for combination i and range increment j, the

$$5 + 4 \cdot (C_i - 1) + (R_j - 1)^{th} \text{ word}$$

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contains expected time to kill (ET) and expected number of rounds (ER) estimates arranged as follows:

ER	ET	
59 45	44 29	28 0

Bit-number

If the estimates are for "soft" targets, then, for combination i and range increment j, the

$$5 + 8 \cdot (C_i - 1) + (R_j - 1)^{th} \text{ word}$$

contains expected time to kill 70% of the target (ET70), rate of fire (ERPS), and attrition (EL) estimates arranged as follows:

ET70	ERPS	EL	
59 51	50 45	44 29	28 0

Bit number
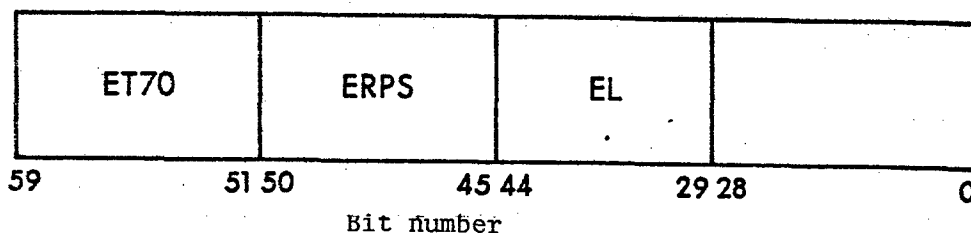
For each of the above two types of estimates, the estimates are scaled before packing.

The preprocessor programs also produce a printed summary consisting of the values supplied plus default values for any estimates omitted, a tabular summary of where default values are used, and a second tabular summary of the estimates. The default values simulate round estimates with minimal destruction capability.

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